Predicting Overall Car Performance Using Artificial Neural Network

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Abstract: *In this paper an Artificial Neural Network (ANN) model was used to help cars dealers recognize the many characteristics of cars, including manufacturers, their location and classification of cars according to several categories including: Buying, Maint, Doors, Persons, Lug_boot, Safety, and Overall. ANN was used in forecasting car acceptability. The results showed that ANN model was able to predict the car acceptability with 99.62 %. The factor of Safety has the most influence on car acceptability evaluation. Comparative study method is suitable for the evaluation of car acceptability forecasting, can also be extended to all other areas.*

Keywords: Artificial neural networks, educational data mining, performance.

1. INTRODUCTION

This study evaluates the utilization of neural networks for predicting suitability of a car. It justifies the use of neural networks in this industry for the prediction process. Generally, car manufacturing industries include design, development, manufacturing, marketing and sale of different equipment for motor vehicles. The set of companies and factories involved in design, manufacturing, marketing, and sale of motor vehicles are a part of this industry.

In 2009, more than 80 million motor vehicles including regular cars and commercial cars were manufactured around the world. In 2008, a total number of 81.9 million cars were sold in the world, with 24.9 million sold in Europe, 23.4 million sold in Asia and Pacific Region, 21.4 million sold in the US and Canada, 5.4 million sold in Latin America, 3.4 million sold in the Middle East, and 2.4 million sold in Africa[1].

When the market was suffering a recession in the US and Japan, Asia and South America expressively grew and got sturdier. Furthermore, it appears that big markets in Russia, Brazil, India and China have practiced a rapid growth. The car industry, as one of the biggest industries in the world holding a great amount of persons, financial and time resources, is in grim need of precise predictions of its future and its contestants in order to reach great and sensitive decisions [2].

Maybe one of the major concerns of the managers and manufacturers in the car industry and the investors in this field is the prediction of cars sales and arrangement for the future manufacturing volume. If a manager can have a more precise prediction regarding the future sales volume and car demand, they can unconditionally enhance the investment volume, employee workforce and optimally use time to reach optimal decisions and convey out instruction plans [3].

2. ARTIFICIAL NEURAL NETWORKS

Artificial intelligence has started from the very beginning, how can we simulate that mind, how can devices have the ability to discriminate, how can we make that device that distinguishes between water and fire?

These devices, despite their high speed and ability to deal with millions of data in parts of the second could not do a lot of things done by the human, for example I bring a small child in the tenth, and offer him a set of images, all this simple child will know the image of the cat, tree and other images. This process is simple may be very complex too for the device and even Super-Computer too![4-10]

From here scientists began to question and research, how this person can do these things, and here the mind is the answer, i.e. trying to imitate the mind and simulating it. But this word of mind despite its simplicity that the human mind is very complex, so scientists had to search more and try to find the things that make up the mind, and from here was the beginning to study the nerve cell, which is the simplest model exists in mind, and the collection of these cells to make a network of cells, and from here we began studying neural networks (note that we are now talking about neural networks within the brain [11-16].

Artificial neural networks (ANNs) are parallel computational models comprised of densely interconnected, adaptive processing units, characterized by an inherent propensity for learning from experience and also discovering new knowledge [17-25]. Due to their excellent capability of self-learning and self-adapting, they have been extensively studied and have been successfully utilized to tackle difficult real-world problems and are often found to be more efficient and more accurate than other classification techniques [26-35]. Classification with a neural network takes place in two

distinct phases. First, the network is trained on a set of paired data to determine the input-output mapping. The weights of the connections between neurons are then fixed and the network is used to determine the classifications of a new set of data. Although many different models of ANNs have been proposed [36-45], the Feedforward Neural Networks (FNNs) are the most common and widely used in a variety of applications [46-57].

3. METHODOLOGY

By looking deeply through the cars types and soliciting the experience of human experts on cars performance, a number of factors that are considered to have an effect on customer response were outlined. These factors were cautiously studied and synchronized into a convenient number appropriate for computer coding within the Just Neural Network (JNN) environment.

These factors were classified as input variables as shown in table 1.

The output variables embody some likely levels of performance of cars in terms of Excel file with a study summary performance of cars as shown in table 2.

There are 1728 instances in the car data set. The data set then was divided into training set and validation set. The ANN model was trained with data set and validated with the validation data set. Furthermore, the Importance of the factors was determined and the most influential factor was known.

Table 1: Input Data Transformation

Attributes:	Usage:	Type:	Values:
Buying	Input	Categorical	v-high, high, med, low
Maint	Input	Categorical	v-high, high, med, low
Doors	Input	Categorical	2, 3, 4, 5-more
Persons	Input	Categorical	2, 4, more
Lug_boot	Input	Categorical	small, med, big
Safety	Input	Categorical	low, med, high

The output Variable:

The attribute which represent the output variable is called overall which can be Un-acceptable, acceptable, good, or very good.

Table2: shows the output variable

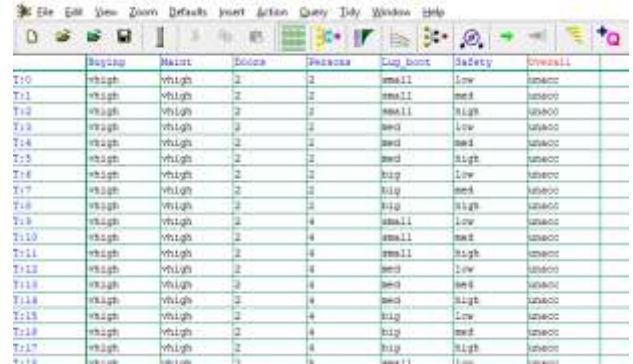| Attributes	Usage	Type	Values
Overall	Output	Categorical	unacc, acc, good, vgood

Figure 1: A snap shot of the data in JNN environment

Figure 2: Most influencing factories on ANN model
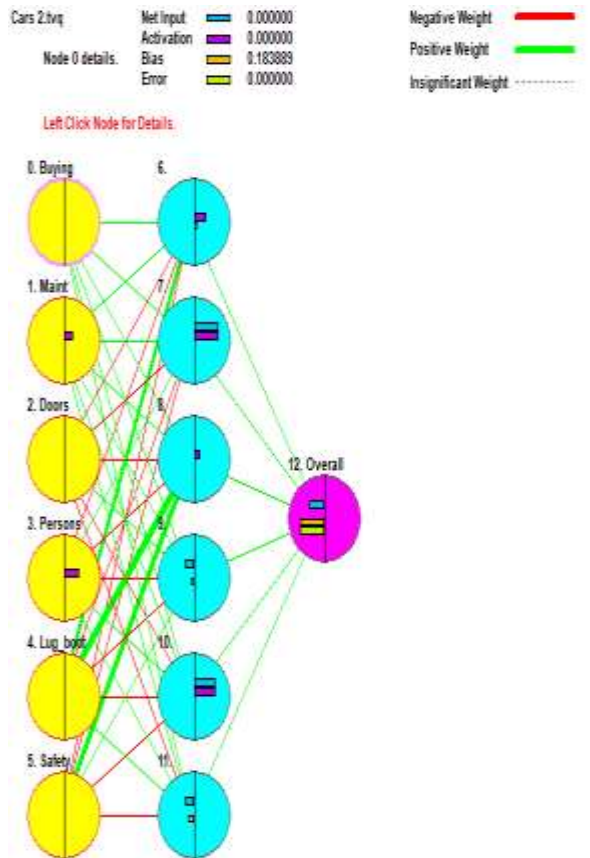

Figure 3: Final ANN model Architecture

Figure 4: Training and validation Summary

4. CONCLUSIONS

An artificial Neural Network model for predicating overall performance of the car was presented. The model used feed forward backpropagation algorithm for training. The factors for the model were obtained from expert in the field. This study showed the potential of the artificial neural network for predicating overall performance of the car.

REFERENCES
1. International Organization of Motor Vehicle Manufacturers (OICA). "2010 Production Statistics". OICA. Retrieved 2018-07-25.
2. Abu-Naser, S., Al-Masri, A., Sultan, Y. A., & Zaqout, I. (2011). A prototype decision support system for optimizing the effectiveness of elearning in educational institutions. International Journal of Data Mining & Knowledge Management Process (IJDKP), 1, 1-13.
3. Abu Naser, S., Zaqout, I., Ghosh, M. A., Atallah, R., & Alajrami, E. (2015). Predicting Student Performance Using Artificial Neural Network: in the Faculty of Engineering and Information Technology. International Journal of Hybrid Information Technology, 8(2), 221-228.
4. Elzamly, A., Abu Naser, S. S., Hussin, B., & Doheir, M. (2015). Predicting Software Analysis Process Risks Using Linear Stepwise Discriminant Analysis: Statistical Methods. Int. J. Adv. Inf. Sci. Technol, 38(38), 108-115.
5. Abu Naser, S. S. (2012). Predicting learners performance using artificial neural networks in linear programming intelligent tutoring system. International Journal of Artificial Intelligence & Applications, 3(2), 65.
6. Elzamly, A., Hussin, B., Abu Naser, S. S., Shibutani, T., & Doheir, M. (2017). Predicting Critical Cloud Computing Security Issues using Artificial Neural Network (ANNs) Algorithms in Banking Organizations. International Journal of Information Technology and Electrical Engineering, 6(2), 40-45.
7. Abu Naser, S. S., & Al-Bayed, M. H. (2016). Detecting Health Problems Related to Addiction of Video Game Playing Using an Expert System. World Wide Journal of Multidisciplinary Research and Development, 2(9), 7-12.
8. Abu Ghali, M. J., Mukhaimer, M. N., Abu Yousef, M. K., & Abu Naser, S. S. (2017). Expert System for Problems of Teeth and Gums. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 198-206.
9. Abu Naser, S., & Akkila, A. N. (2008). A Proposed Expert System for Skin Diseases Diagnosis. INSInet Publication. Journal of Applied Sciences Research, 4(12), 1682-1693.
10. El Agha, M., Jarghon, A., & Abu Naser, S. S. (2017). Polymyalgia Rheumatic Expert System. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 125-137.
11. Abu Naser, S., Al-Dahdooh, R., Mushtaha, A., & El-Naffar, M. (2010). Knowledge management in ESMDA: expert system for medical diagnostic assistance. AIML Journal, 10(1), 31-40.
12. Almurshidi, S. H., & Abu-Naser, S. S. (2018). EXPERT SYSTEM FOR DIAGNOSING BREAST CANCER. Al-Azhar University, Gaza, Palestine.
13. Abu Naser, S. S., & Alawar, M. W. (2016). An expert system for feeding problems in infants and children. International Journal of Medicine Research, 1(2), 79-82.
14. Al Rekhawi, H. A., Ayyad, A. A., & Abu Naser, S. S. (2017). Rickets Expert System Diagnoses and Treatment. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 149-159.
15. Abu Naser, S. S., & AlDahdooh, R. M. (2016). Lower Back Pain Expert System Diagnosis and Treatment. Journal of Multidisciplinary Engineering Science Studies (JMESS), 2(4), 441-446.
16. Nabahin, A., Abou Eloun, A., & Abu Naser, S. S. (2017). Expert System for Hair Loss Diagnosis and Treatment. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 160-169.
17. Abu Naser, S. S., & Alhabbash, M. I. (2016). Male Infertility Expert system Diagnoses and Treatment. American Journal of Innovative Research and Applied Sciences, 2(4).
18. Qwaider, S. R., & Abu Naser, S. S. (2017). Expert System for Diagnosing Ankle Diseases. International Journal of Engineering and Information Systems (IJEAIS), 1(4), 89-101.
19. Abu Naser, S. S., & Al-Hanjori, M. M. (2016). An expert system for men genital problems diagnosis and treatment. International Journal of Medicine Research, 1(2), 83-86.
20. Naser, S. S. A., & Hasanein, H. A. A. (2016). Ear Diseases Diagnosis Expert System Using SL5 Object. World Wide Journal of Multidisciplinary Research and Development, 2(4), 41-47.
21. Nassr, M. S., & Abu Naser, S. S. (2018). Knowledge Based System for Diagnosing Pineapple Diseases.

International Journal of Academic Pedagogical Research (IJAPR), 2(7), 12-19.

22. Abu Naser, S. S., & El-Najjar, A. E. A. (2016). An expert system for nausea and vomiting problems in infants and children. International Journal of Medicine Research, 1(2), 114-117.

23. Elqassas, R.,& Abu-Naser, S. S. (2018). Expert System for the Diagnosis of Mango Diseases. International Journal of Academic Engineering Research (IJAER) 2 (8), 10-18.

24. Naser, S. S. A., & Hilles, M. M. (2016). An expert system for shoulder problems using CLIPS. World Wide Journal of Multidisciplinary Research and Development, 2(5), 1-8.

25. Musleh, M. M., & Abu-Naser, S. S. (2018). Rule Based System for Diagnosing and Treating Potatoes Problems. International Journal of Academic Engineering Research (IJAER) 2 (8), 1-9.

26. Abu Naser, S. S., & Hamed, M. A. (2016). An Expert System for Mouth Problems in Infants and Children. Journal of Multidisciplinary Engineering Science Studies (JMESS), 2(4), 468-476.

27. Almadhoun, H., & Abu-Naser, S. (2017). Banana Knowledge Based System Diagnosis and Treatment. International Journal of Academic Pedagogical Research (IJAPR), 2(7), 1-11.

28. Abu Naser, S. S., & Mahdi, A. O. (2016). A proposed Expert System for Foot Diseases Diagnosis. American Journal of Innovative Research and Applied Sciences, 2(4), 155-168.

29. Dahouk, A. W., & Abu-Naser, S. S. (2018). A Proposed Knowledge Based System for Desktop PC Troubleshooting. International Journal of Academic Pedagogical Research (IJAPR) 2 (6), 1-8

30. Abu Naser, S. S., & Ola, A. Z. A. (2008). AN EXPERT SYSTEM FOR DIAGNOSING EYE DISEASES USING CLIPS. Journal of Theoretical & Applied Information Technology, 4(10).

31. Bakeer, H., & Abu-Naser, S. S. (2017). Photo Copier Maintenance Expert System V. 01 Using SL5 Object Language. International Journal of Engineering and Information Systems (IJEAIS) 1 (4), 116-124.

32. Abu Naser, S. S., & Shaath, M. Z. (2016). Expert system urination problems diagnosis. World Wide Journal of Multidisciplinary Research and Development, 2(5), 9-19.

33. Khella, R., & Abu-Naser, S. S. (2017). Rule Based System for Chest Pain in Infants and Children. International Journal of Engineering and Information Systems 1 (4), 138-148.

34. Abu-Naser, S. S., El-Hissi, H., Abu-Rass, M., & El-Khozondar, N. (2010). An expert system for endocrine diagnosis and treatments using JESS. Journal of Artificial Intelligence; Scialert, 3(4), 239-251.

35. Mrouf, A., Albatish, I., Mosa, M., & Abu Naser, S. S. (2017). Knowledge Based System for Long-term Abdominal Pain (Stomach Pain) Diagnosis and Treatment. International Journal of Engineering and Information Systems (IJEAIS) 1 (4), 71-88.

36. Abu Naser, S. S., Baraka, M. H.,& Baraka, A. R. (2008). A Proposed Expert System For Guiding Freshman Students In Selecting A Major In Al-Azhar University, Gaza.Journal of Theoretical & Applied Information Technology 4(9).

37. Abu-Nasser, B. S., & Abu-Naser, S. S. (2018). Cognitive System for Helping Farmers in Diagnosing Watermelon Diseases. International Journal of Academic Information Systems Research (IJAISR) 2 (7), 1-7.

38. Abu Naser, S. S., Alamawi, W. W., & Alfarra, M. F. (2016). Rule Based System for Diagnosing Wireless Connection Problems Using SL5 Object. International Journal of Information Technology and Electrical Engineering 5(6), 26-33.

39. Akkila, A. N., & Abu Naser, S. S. (2016). Proposed Expert System for Calculating Inheritance in Islam. World Wide Journal of Multidisciplinary Research and Development 2 (9), 38-48.

40. Abu Naser, S. S., & Zaqout, I. S. (2016). Knowledge-based systems that determine the appropriate students major: In the faculty of engineering and information technology, World Wide Journal of Multidisciplinary Research and Development 2 (10), 26-34.

41. AbuEl-Reesh, J. Y., & Abu Naser, S. S. (2017). A Knowledge Based System for Diagnosing Shortness of Breath in Infants and Children. International Journal of Engineering and Information Systems (IJEAIS) 1 (4), 102-115.

42. Abu Naser, S. S., & Bastami, B. G. (2016). A proposed rule based system for breasts cancer diagnosis. World Wide Journal of Multidisciplinary Research and Development 2 (5), 27-33.

43. Abu-Nasser, B. S. (2017). Medical Expert Systems Survey. International Journal of Engineering and Information Systems, 1(7), 218-224.

44. Abu Naser, S. S., & ALmursheidi, S. H. (2016). A Knowledge Based System for Neck Pain Diagnosis. World Wide Journal of Multidisciplinary Research and Development (WWJMRD), 2(4), 12-18.

45. Azaab, S., Abu Naser, S., & Sulisel, O. (2000). A proposed expert system for selecting exploratory factor analysis procedures. Journal of the College of Education 4 (2), 9-26.

46. Abu-Naser, S. S., Kashkash, K. A., & Fayyad, M. (2010). Developing an expert system for plant disease diagnosis. Journal of Artificial Intelligence, 3 (4), 269-276.

47. Barhoom, A. M., & Abu-Naser, S. S. (2018). Black Pepper Expert System. International Journal of Academic Information Systems Research, (IJAISR) 2 (8), 9-16.

48. AlZamily, J. Y., & Abu-Naser, S. S. (2018). A Cognitive System for Diagnosing Musa Acuminata Disorders. International Journal of Academic Information Systems Research, (IJAISR) 2 (8), 1-8.

49. Alajrami, M. A., & Abu-Naser, S. S. (2018). Onion Rule Based System for Disorders Diagnosis and Treatment. International Journal of Academic Pedagogical Research (IJAPR), 2 (8), 1-9.

50. Al-Shawwa, M., Al-Absi, A., Abu Hassanein, S., Abu Baraka, K., & Abu-Naser, S. S. (2018). Predicting Temperature and Humidity in the Surrounding Environment Using Artificial Neural Network. International Journal of Academic Pedagogical Research (IJAPR), 2(9), 1-6.

51. Salah, M., Altalla, K., Salah, A., & Abu-Naser, S. S. (2018). Predicting Medical Expenses Using Artificial Neural Network. International Journal of Engineering and Information Systems (IJEAIS), 2(20), 11-17.

52. Marouf, A., & Abu-Naser, S. S. (2018). Predicting Antibiotic Susceptibility Using Artificial Neural Network. International Journal of Academic Pedagogical Research (IJAPR), 2(10), 1-5.

53. Jamala, M. N., & Abu-Naser, S. S. (2018). Predicting MPG for Automobile Using Artificial Neural Network Analysis. International Journal of Academic Information Systems Research (IJAISR), 2(10), 5-21.

54. Kashf, D. W. A., Okasha, A. N., Sahyoun, N. A., El-Rabi, R. E., & Abu-Naser, S. S. (2018). Predicting DNA Lung Cancer using Artificial Neural Network. International Journal of Academic Pedagogical Research (IJAPR), 2(10), 6-13.

55. Al-Massri, R. Y., Al-Astel, Y., Ziadia, H., Mousa, D. K., & Abu-Naser, S. S. (2018). Classification Prediction of SBRCTs Cancers Using Artificial Neural Network. International Journal of Academic Engineering Research (IJAER), 2(11), 1-7.

56. Alghoul, A., Al Ajrami, S., Al Jarousha, G., Harb, G., & Abu-Naser, S. S. (2018). Email Classification Using Artificial Neural Network. International Journal of Academic Engineering Research (IJAER), 2(11), 8-14.

57. Metwally, N. F., AbuSharekh, E. K., & Abu-Naser, S. S. (2018). Diagnosis of Hepatitis Virus Using Artificial Neural Network. International Journal of Academic Pedagogical Research (IJAPR), 2(11), 1-7.

58. Heriz, H. H., Salah, H. M., Abu Abdu, S. B., El Sbihi, M. M., & Abu-Naser, S. S. (2018). English Alphabet Prediction Using Artificial Neural Networks. International Journal of Academic Pedagogical Research (IJAPR), 2(11), 8-14.

59. El_Jerjawi, N. S., & Abu-Naser, S. S. (2018). Diabetes Prediction Using Artificial Neural Network. International Journal of Advanced Science and Technology,124, 1-10.

60. Ashqar, B. AM, & Abu-Naser, S. S. (2019). Image-Based Tomato Leaves Diseases Detection Using Deep Learning. International Journal of Academic Engineering Research (IJAER) 2 (12), 10-16.